


Nuclear Malaysia Technical Convention 2011 (NTC2011)
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**EXPERIENCED IN CONDUCTING
 RADIOLOGICAL IMPACT ASSESSMENT
 (RIA) IN OIL AND GAS INDUSTRY**

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REQUIREMENTS

- Atomic Energy Licensing Act 1984, Act 304
- Guidelines on radiological monitoring for oil and gas facilities associated with Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM), LEM/TEK/30 SEM.2, September 1996
- Code of practice on radiation protection relating to Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM) in oil and gas Facilities (LEM/TEK/58, 6 March 2009)

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RADIOLOGICAL IMPACT ASSESSMENT

- ▶ 5.1.4 Management of scales and sludge LEM/TEK/30 SEM.2,
- ▶For disposal purpose the operators shall be required to carry out a Radiological Impact Assessment (RIA) of all proposed disposals to demonstrate that no member of public will be exposed to more than 1 mSv/y from all activities....
- ▶ 21.0 Radiological Impact Assessment (RIA) LEM/TEK/58,
- ▶ Radiological Impact Assessment (RIA) is required to be carried out by the disposal site operator to dispose of TENORM wastes of more than 3 Bq/g TAC by landfill or other methods.....

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METHODOLOGY: SOURCE TERM

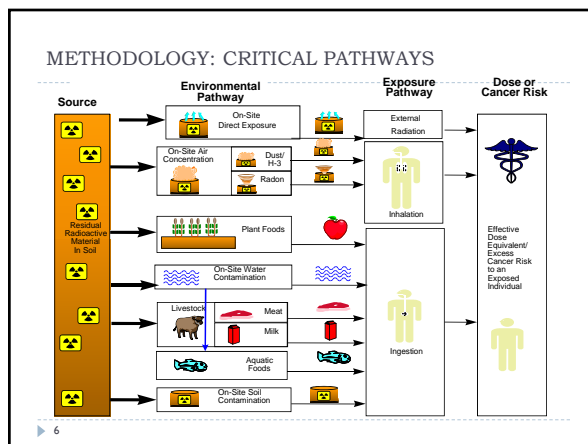


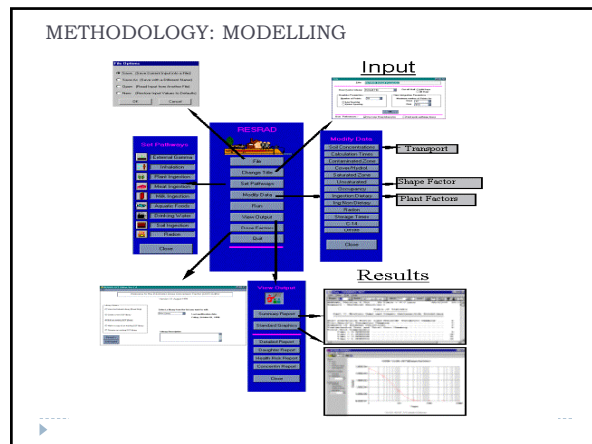
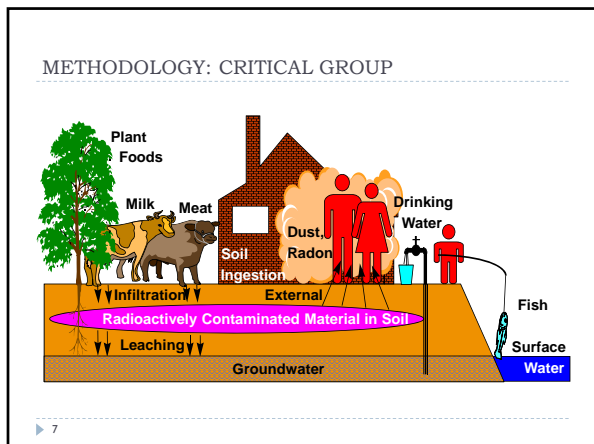
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METHODOLOGY: RADIOLOGICAL CRITERIA

- ▶ 1 mSv/y for the individual member of the public and 1 man.Sv for collective dose of the overall population.

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- ### SITE INPUT PARAMETERS
- ▶ **Physical parameters** (size, depth, density, porosity, diffusion coefficient)
 - ▶ **Hydrological parameters** (conductivity, gradient, water table depth)
 - ▶ **Geochemical parameters** (distribution coefficient, leach rate, solubility)
 - ▶ **Meteorological parameters** (precipitation, erosion, runoff)
 - ▶ **Usage and consumption parameters** (inhalation, irrigation, ingestion, occupancy)
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TAC FORMULA (LEM/TEK/58, 6 March 2009)

$$TAC = (6 \times Ra-226) + (8 \times Ra-228) \text{ Bq/g}$$

The control limit for TENORM wastes is 3.0 Bq/g (inclusive background) TAC

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EXAMPLE RADIOLOGICAL IMPACT ASSESSMENT

LEM/TEK/30 SEM.2

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EXAMPLE: LEM/TEK/30 SEM.2

Treated sludge	Activity (Bq/kg)	
	Ra-226	Ra-228
Mean ± σ	82 ± 49	97 ± 68

Background	Activity (Bq/kg)	
	Ra-226	Ra-228
Mean ± σ	20 ± 8	34 ± 14

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EXAMPLE:LEM/TEK/30 SEM.2



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EXAMPLE:LEM/TEK/30 SEM.2

<i>Elapsed time (years)</i>	Total annual effective dose (mSv)
1	0.23
3	0.22
10	0.20
30	0.20
100	0.21
300	0.18
1000	0.10

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EXAMPLE
TOTAL ACTIVITY CONCENTRATION

LEM/TEK/58

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EXAMPLE:LEM/TEK/58

- ▶ Treated sludge
- ▶ Activity concentration of Ra-226= 0.082 Bq/g
- ▶ Activity concentration of Ra-228= 0.097 Bq/g
- ▶ Therefore,
- ▶ $Average\ TAC = (6 \times 0.082) + (8 \times 0.097)$
- ▶ $= (0.492) + (0.776)$
- ▶ $= 1.268\ Bq/g$

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EXAMPLE:LEM/TEK/58

- ▶ Background Soil Sample
- ▶ Activity concentration of Ra-226= 0.020 Bq/g
- ▶ Activity concentration of Ra-228= 0.034 Bq/g
- ▶ Therefore,
- ▶ $Average\ TAC = (6 \times 0.020) + (8 \times 0.034)$
- ▶ $= (0.12) + (0.272)$
- ▶ $= 0.392\ Bq/g$

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EXAMPLE:LEM/TEK/58

- ▶ Therefore TAC waste (treated sludge) inclusive background is 1.66 Bq/g which is well below the control limit for TENORM waste (3Bq/g inclusive background).
- ▶ Since the calculated value does not exceed the control limit therefore the management of the sludge does not requires RIA for disposal and also does not require a valid license from the AELB.

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